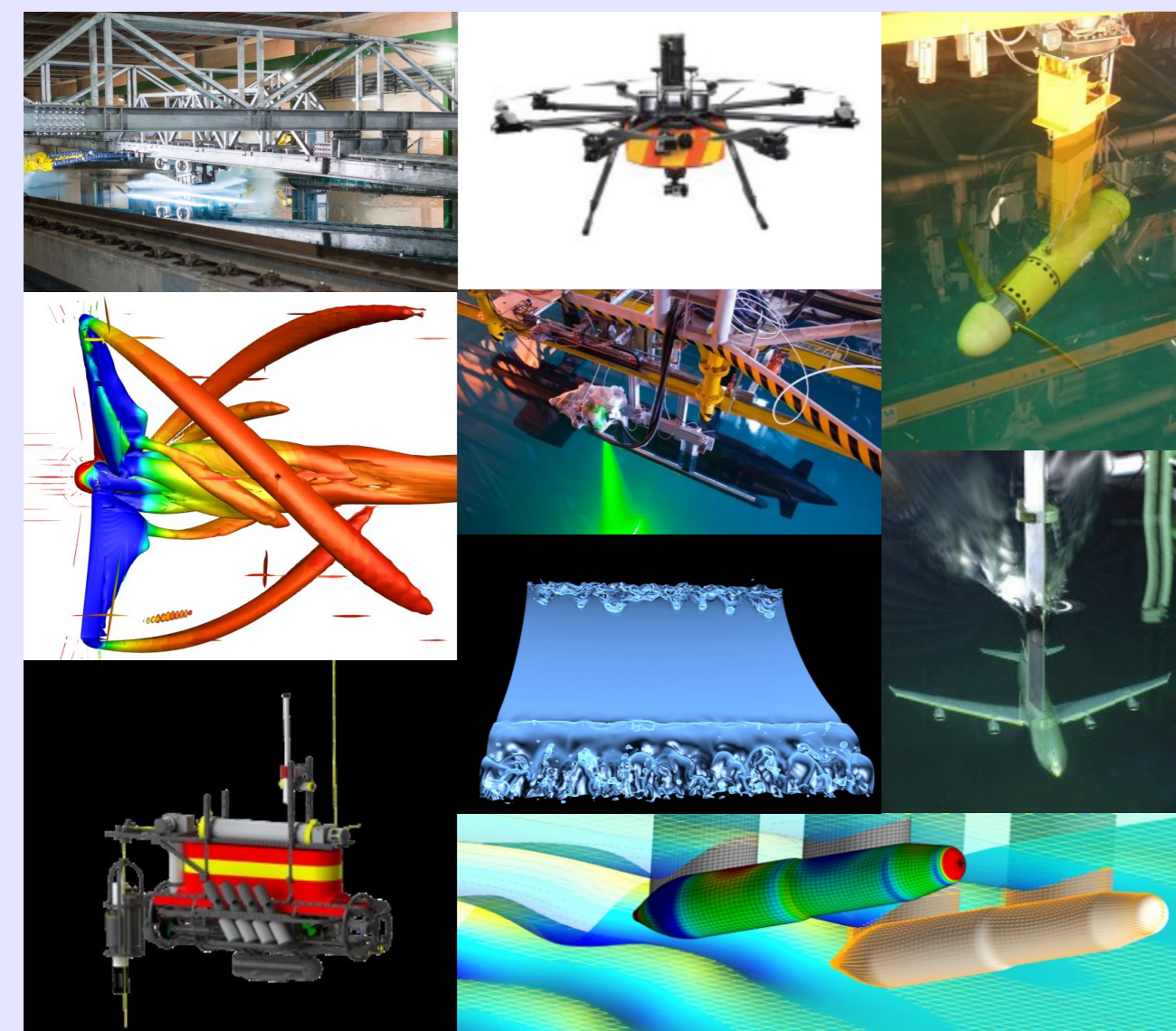
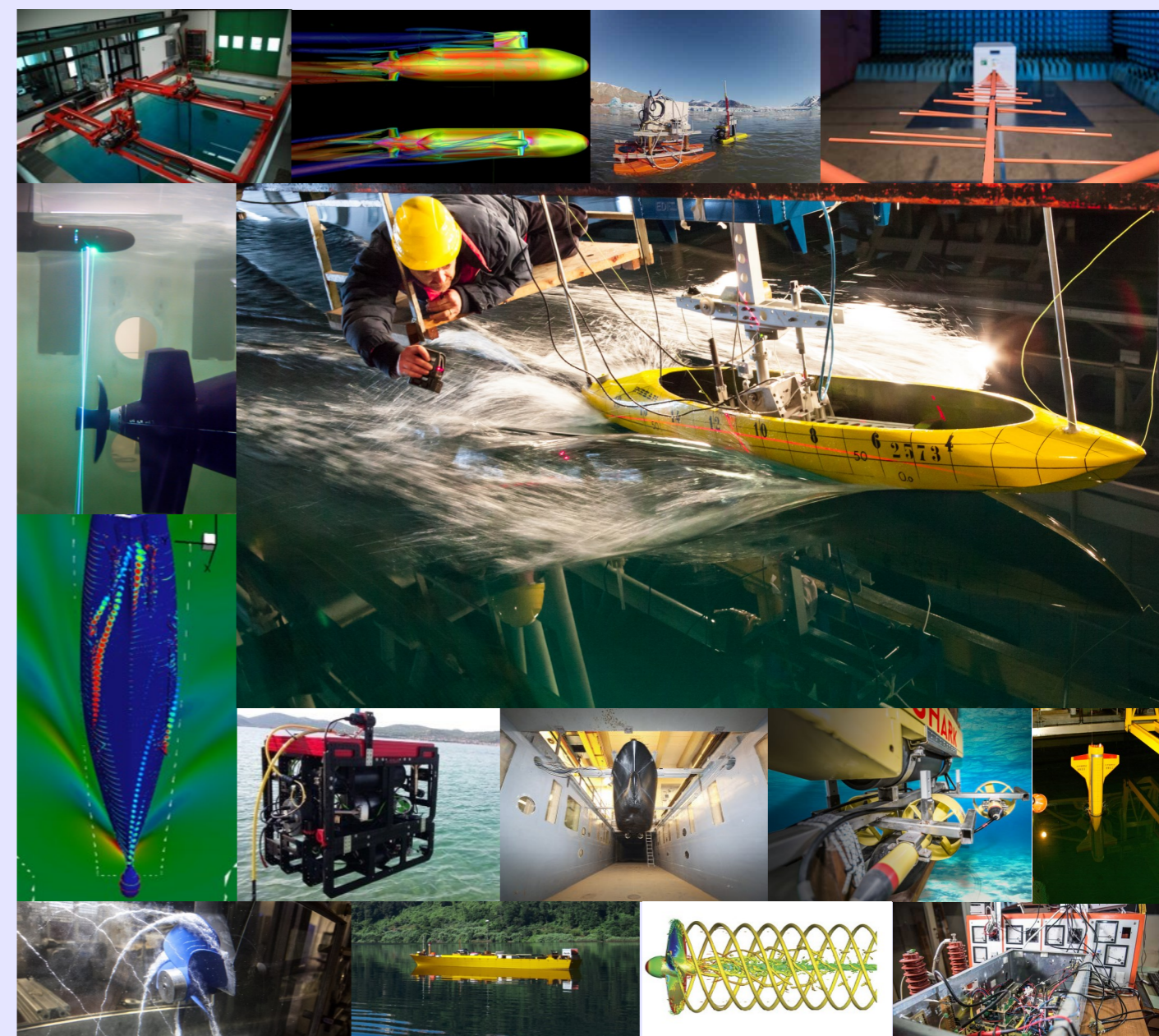


Industrial partnership

INM has a long history and a wide experience in providing support to industry. Here is a short list of partners.



Engineering, ICT and Technologies for Energy and Transportation Department (DIETET)



CNR-INM sites

- Headquarters, located in Rome, via di Vallerano 139, 00128 ★
- Genoa Branch Office, at the CNR Research Area of Genoa ★
- Palermo Branch Office, at the CNR Research Area of Palermo ★
- Rome Branch Office "Section of Acoustics and Sensors O.M. Corbino", at the CNR Research Area of Rome Tor Vergata ★

Contacts

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Mission and Profile

The Institute of Marine Engineering (INM) belongs to the Department of Engineering, ICT and Technologies for Energy and Transport (DIITET) of the National Research Council of Italy (CNR).

INM research activities are mainly related to the following thematic areas:

- Models, technologies and innovative design systems for marine / maritime sector
- Marine vehicles
- Marine robotics
- Marine renewable energy
- Environmental, underwater and geo- acoustic
- Acoustic characterization of materials, structures and environments
- Development and applications of instrumentation (sensors, actuators, transducers)
- Logistics and transport in maritime environment
- Marine vehicles energy management on-board and in the port / coastal areas

INM staff includes 74 research scientists and engineers

Scientific Expertise

The scientific expertise of INM include:

- Experimental methods and mathematical models for numerical fluid dynamics, structural dynamics, hydroelasticity, underwater acoustics
- Models and methods for multidisciplinary analysis and optimization
- Models and methods for resistance, sea-keeping and maneuverability of marine vehicles
- Hydrodynamics and hydroacoustics of marine propellers and propeller-hull interaction, vibro-acoustic analysis of marine structures, interior and exterior hydrodynamic noise
- Experimental and numerical methods for the characterisation of hyperhydrophobic materials
- Design, development and operation of prototype unmanned marine vehicles
- Modelling and identification, cooperative NGC and mission control of heterogeneous prototype mobile marine robots
- Decision making and machine learning (optimization, optimal control, learning from data)
- Development of smart generation and distribution systems for energy sustainability in isolated electrical networks – smart grids (small islands, ports, vessels, coastal areas)
- Sensor networks and communication systems for monitoring protected marine areas
- Electromagnetic Compatibility
- Development of power electronic converters, including power quality and Electromagnetic Interference (EMI) issues
- Modelling, identification and intelligent control of renewable energy sources and rotating/linear electrical drives
- Energy efficiency for marine / terrestrial vehicles and buildings
- Characterization of acoustic properties of materials, structures and environments
- Development of methods and procedures for the calibration and testing of underwater electroacoustic systems (hydrophones, projectors, arrays, autonomous recorders)
- Acoustic characterization of environmental spaces
- Study of acoustic properties of materials
- Environmental acoustical monitoring of industrial plants
- Psychoacoustics and sound quality
- Characterization of materials for physical and chemical sensors
- Development of multi sensor units for environment, security and medicine



Test Facilities and Laboratories

The INM's large test facilities are equipped with cutting-edge technology instrumentation and measurement systems. INM's labs provide for the construction and equipment of almost all models tested in its facilities.

Umberto Pugliese Towing Tank: one of the largest in the world (470 m × 13.5 m × 6.5 m) with maximum carriage speed of 15 m/s. It offers excellent capabilities for the investigation of large, self-propelled models of diverse marine vehicles

Emilio Castagneto Seakeeping Tank: dimensions are 220 m × 9 m × 3.5 m, and maximum carriage speed is 10 m/s. It is equipped with a wave generator providing regular or irregular waves for, among others, seakeeping and ride comfort tests

Circulating Water Channel: it has test section 10 m long, 3.6 m wide and 2.25 m deep, with a maximum water speed of 5 m/s. It can be operated with a free surface and in high vacuum conditions (minimum pressure of 4 kPa)

Maneuvering Basin: INM uses the nearby volcanic Lake Nemi. For much of the year it offers weather conditions suitable for testing. The area used for the tests (1300 m × 1800 m) is about 34 m deep

CEIMM Cavitation Tunnel: it is owned by the Italian Navy and operated by CNR-INM. Test section sizes are 0.6 m × 0.6 m × 2.6 m, the maximum water speed is 12 m/s and the static pressure can be maintained between 30 and 150 kPa

Hydraulic Channel: it is 27 m long and has a cross section of 0.6 m × 1.25 m. The test section is 10 m long. It is used for experiments in basic fluid dynamics

Sloshing Lab: it is used to conduct experimental activities on the sloshing flows in a LNG ship tank and water entry and exit of 2D ship sections

Vibration Lab: it is used for structural identification aimed at model updating and prevention of fatigue failure

Erosion Lab: it is a water tunnel with test section of 80 × 80 mm², temperature control, and a test speed up to 50 m/s. It is used for cavitation erosion tests on materials

High Speed Ditching Facility: funded by European grants (SMAES, EU FP7; SARA, EU H2020), it is used to study the impact (up to a speed of 50 m/s) of aircraft fuselage in phase of emergency sea landing.

Marine Robotics Lab: includes hardware and software labs and prototype marine robots, such as R2 ROV, Charlie USV, Proteus USSV/ROV, e-URoPe ROV/AUV, MARC magnetic climbing robot, 3 UAVs, VideoRay mini-ROV, SWAMP modular ASV(s), a couple of innovative electrical robotic arms and a number of mini-robots

Smart Community Lab: prototyping of intelligent electronic devices, hardware and software monitoring and control solutions for smart grids. A reduced scale medium voltage network is also available for power line communication demonstration tests

Electromagnetic Compatibility Lab: includes a shielded electromagnetic semi-anechoic room (9.4 m × 6.4 m × 5.55 m) and a GTEM 750 cell. They are used to perform emission and radiated immunity tests in the frequency range 30 MHz ÷ 18 GHz

Energy Conversion Lab: development of power electronic converter prototypes, modeling, identification and intelligent control of renewable energy sources and rotating/linear electrical machines

Underwater Acoustics Lab: it is equipped with a 6 m × 4 m × 5.5 m deep water tank for calibration and testing of hydrophones and transducers in the frequency range from a few kHz up to 500 kHz. Two windows located at half depth on one of the tank walls allow combined acoustical/optical measurements. A smaller tank is available for ultrasonic measurements up to the MHz range

Electronics for sensors and Environmental Acoustics Lab: development of multi-sensor units for environmental, safety and medical applications. Monitoring of the environmental acoustic impact in industrial/urban contexts

Laboratory of Acoustics Research Applications for Cultural Heritage: includes a testing facility for non-destructive structural diagnostics, a listening room (20 m²) for subjective tests and Odeon Room Acoustic software for acoustic modelling, reverberation rooms (V₁ = 55.8 m³; V₂ = 63.2 m³; test area 4 m × 3.7 m) used for measurement of structural acoustic transmission loss

Research Networks and Projects

INM is involved in several initiatives within the frame of the activities of national and international bodies.

In cooperation with the Italian Navy, participates in national military research programs and develops initiatives coordinated by the European Defence Agency (EDA). INM has a long history participation in projects funded by the U.S. Navy through the Office of Naval Research (ONR) and participates to the NATO activities through the AVT groups. Takes part in European networks of experts on marine and maritime themes (Seas-Era, etc.) and provides scientific and technical support to competent ministries at the IMO, the United Nations Office for the safety of navigation. It is member of the International Towing Tank Conference (ITTC), a world-wide independent association of hydrodynamics research organizations that operate towing tanks or similar model test laboratories, and of the International Ship and Offshore Structures Congress (ISSC), a forum for the exchange of information by experts undertaking and applying marine structural research.

It is partner of numerous EC projects (H2020, Interreg, LIFE, etc.) and coordinates, among others, the national project TRIM (Technology and Industrial Research for Marine Transport)

